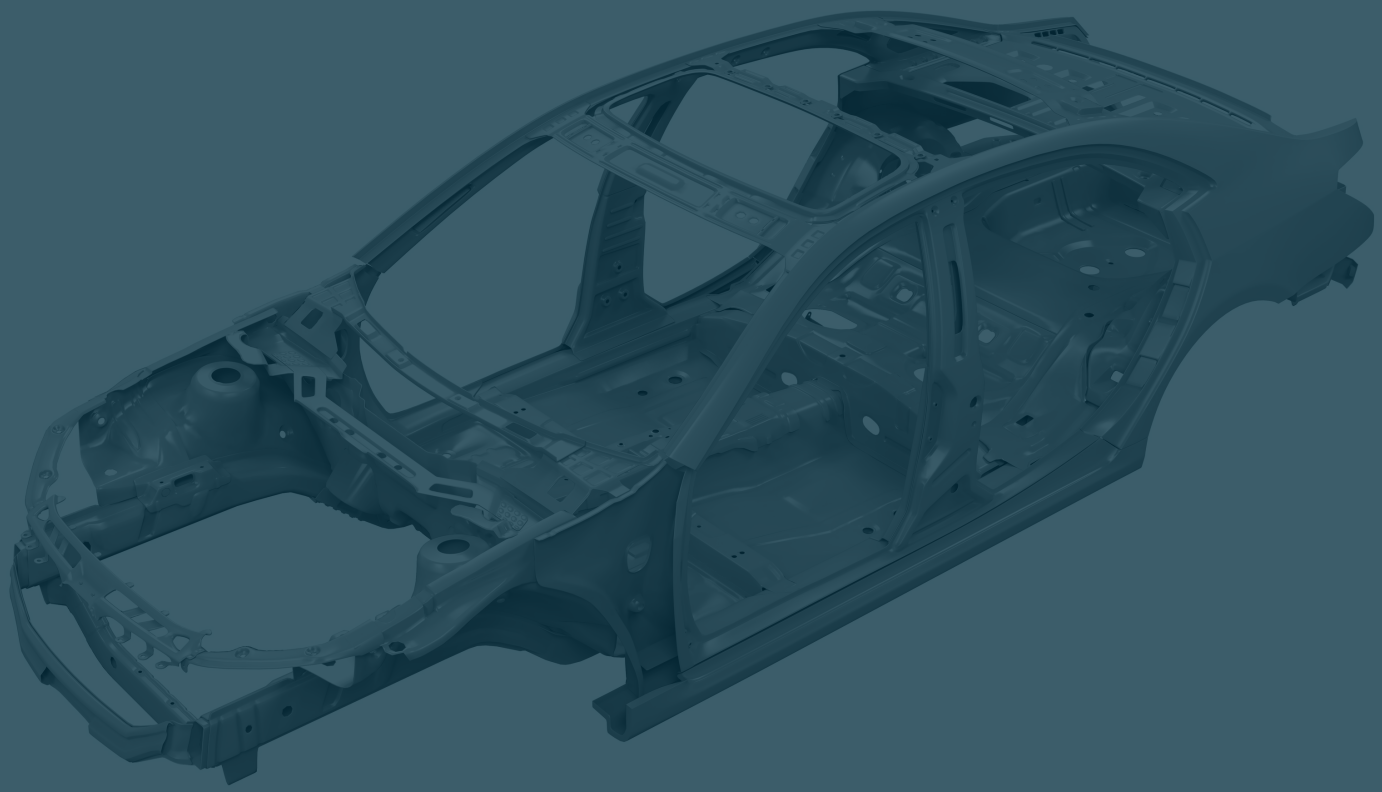
DUCKER

2022 Mega-Casting Trends for Automotive Manufacturers



SUMMARY

Why Are Manufacturers so Interested in Mega-Castings?

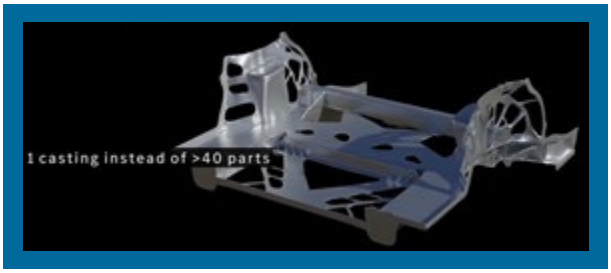
Nio and Xpeng, two Chinese EV startups, have already followed Tesla's lead by ordering injection molding machines capable of 12,000 tons of force from IDRA (LK Machinery). Now it's Mercedes-Benz's turn for its EQXX to succumb to giant castings. The German automaker is aiming for maximum cost reduction and weight reduction on a low-volume vehicle unveiled as a concept during the last Consumers Electronic Show. The vehicle is a technological exercise as Mercedes-Benz aims not only for lower production costs, but also for weight reduction (which mega-casting makes possible) leading to a better management of energy consumption to increase range.

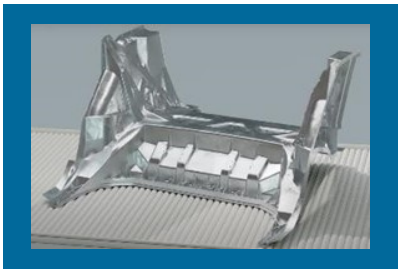
More Followers to Adopt Tesla's Strategy

Volvo has just announced its desire to build body-in-white architectures using giant aluminum castings

The Swedish manufacturer is investing more than a billion euros for its future EV's and is seeking to meet several objectives with mega-casting, namely to reduce the weight of vehicles, to improve the use of interior space, and to be able to develop several vehicles capable of using the same modules based on the same body-in-white elements (mega-castings).

Volkswagen also revealed recently that their Project Trinity will likely use Tesla-like manufacturing processes, including potential mega-casting and ramped-up automation, aiming to speed up production.

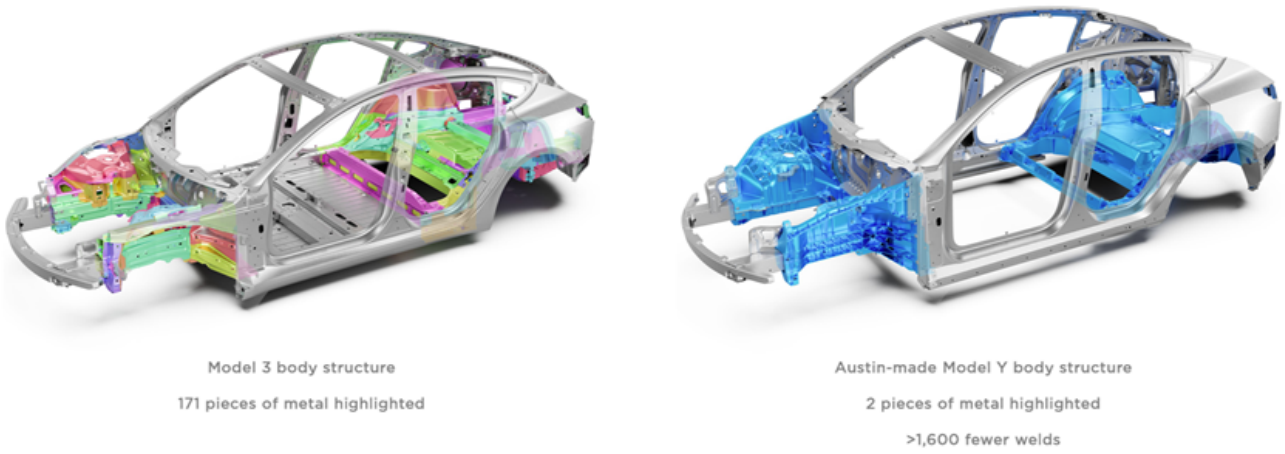




Source: Tesla

Why Are Automakers Interested in Giga-Casting

Elon Musk said this solution removes 300 robots from the assembly line on Munro Live (YouTube). Mega-castings allow to improve profitability by reducing assembly time, length of the assembly line. In terms of reparability, the casting component is not of a nature to be straightened or even replaced. If it bends or breaks, the vehicle will be a total loss. However, this is unlikely to slow Tesla down in its approach as the manufacturer is considering a new Giga-casting part for the front of the future Model 3. The limited experience with such large aluminum castings integrated into the body-in-white leaves many doubts about reparability, life cycle and aging. With cost-reduction being the end-game for Mega-casting technology, the sudden enthusiasm of premium manufacturers for these solutions tends to prove that the economic equation and the profitability of electric vehicles are far from being resolved



Source: Tesla

171 Parts >>> 2 Parts

Precautions to be Taken Regarding the Conclusions

In terms of repair, the casting is not of a nature to be straightened or even replaced. If it breaks, the vehicle will be classified as a wreck. The lack and cost of parts, as well as the below-average ability for repair, are reasons enough for a minor fender-bender to turn a Tesla into a wreck in the eyes of insurers (full reimbursement of value in the US). Cars with these parts are therefore stiffer, simpler, but also more disposable, especially since the aging of such massive casting parts is not yet known.

The set-up time and the scrap-rate (45% at Tesla in 2021) are often highlighted with more importance than with stamping parts. If the process is faster once the series is launched, it also requires more adjustments at the very beginning. Confirmed by suppliers, the delays Tesla has experienced in Berlin and Austin are not only administrative or financial, but also technical. However, this is unlikely to slow Tesla down in its approach as the manufacturer is considering a new Giga-casting for the front of the future Model 3 and Model Y additional to a tray for the future batteries that are also made of a single piece of aluminum casting.

The lightweighting of mega-casting is not as effective as assembly solution. To ensure that molten aluminum can reach far-end of parts without turbulent flow, Tesla has to give up thin wall design on the areas which do not require high strength and stiffness (e.g. wheel well, rear floor). In general, mega casting does now allow for extremely low thickness: no less than 2 to 3mm thick versus up to 0.7mm for sheet metal. One of the major innovations of Mercedes's Bionicast is to apply bionic engineering to reduce excess material to a minimum on those areas. Volvo also expects 15% weight-saving compared to steel solutions by design optimization on mega-casting.

Mega-casting also helps to increase the material utilization as well as the use of secondary (scrap) aluminum. According to Volvo, 100% aluminum will be utilized (versus 55% of stamped steel parts), and half of the aluminum can be secondary alloy, leading to at least 35% CO2 emissions reduction.

Innovation by Trial and Error

The limited experience with such large aluminum castings integrated into the body-in-white leaves many doubts about repair ability, life cycle and aging. The adoption of these mega-castings by manufacturers other than Tesla are perplexing at this point. To develop a definitive idea, volume increases, technological improvements, and the first customer feedback on high-mileage vehicles will be needed. However, with certainty the sudden enthusiasm of premium manufacturers for these solutions tends to prove that the economic equation and the profitability of electric vehicles are far from being resolved.

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